DOCUMENT RESUME

ED 373 756 IR 016 766

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TITLE Trends in Instructional Technology: Educational Reform and Electronic Performance Support Systems.
PUB DATE 94
NOTE 12p.; In: Proceedings of Selected Research and Development Presentations at the 1994 National Convention of the Association for Educational Communications and Technology Sponsored by the Research and Theory Division (16th, Nashville, TN, February 16-20, 1994); see IR 016 784.
PUB TYPE Viewpoints (Opinion/Position Papers, Essays, etc.) (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Competence; *Computer Assisted Instruction; Computer Software Development; *Educational Change; *Educational Technology; Elementary Secondary Education; Futures (of Society); Instructional Improvement; *Intelligent Tutoring Systems; Job Skills; School Restructuring; Technological Advancement; *Training
IDENTIFIERS Information Age; *Performance Support Systems; Secretarys Comm on Achieving Necessary Skills

ABSTRACT

As society moves into the information age, changes need to be made in the educational process to ensure that students will have the skills they will need in the changing workplace. By keeping abreast of the changes in society, education, and training, instructional technology professionals can play a key role in restructuring the educational system. This paper addresses two trends in the educational reform movement: integrating electronic technology in the classroom and the uses of electronic performance support systems (EPSS) as a tool for promoting training and support in education and in the workplace. An EPSS is an integrated electronic system that provides training and support at the moment of need for the employee. The concept of EPSS is examined, as well as its place in the educational process. Finally, the software development process and the need for change with the advent of such trends as EPSS are discussed. (Contains 40 references.) (Author/JLB)

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Trends in Instructional Technology: Educational Reform and Electronic Performance Support Systems

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Abstract: As a result of [the society] moving into the information age, changes in the educational process as well in the workplace are inevitable. Parents, students, school officials and business leaders are currently experiencing the effects of the information explosion era on a daily basis. Upgrades and new releases of computer hardware and software are occurring almost before we can fully understand our old systems. Are decision makers ready to make the changes necessary to prepare students with the competency and foundation skills (as identified by the Secretary's Commission on Achieving Necessary Skills) that they will need for the changing workplace? This paper will address two trends in the instructional technology field: reforming the educational process and implementing electronic performance support systems into the workplace. These trends are important because they have influence on moving the teaching and learning process to a new evolutionary stage.

As society approaches the 21st century, technology will play an important role in the lives of adults as well as in the lives of children. Business leaders, school officials, parents, and students need to be aware of the impact technological change will have on the educational system as well as on business and industry (Secretary's Commission on Achieving Necessary Skills [SCANS], 1991). Furthermore, with markets becoming more global and companies desperately striving to stay ahead, jobs of the future will demand more highly skilled employees (Naisbitt, & Aburdene, 1985; SCANS, 1991; Work Force 2000, 1988). During the coming years, jobs that require skills with information-processing technology will be of the norm rather than a rarity (Naisbitt & Aburdene, 1991). To prepare students for a work force that is different from their parents Reigeluth (1992) argues that the educational system requires moving from an industrial age model towards an information-age model that views the educational process as the integration of learning tasks, with the teacher as a coach or facilitator using electronic technologies as tools within the classroom.

The mastery of reading, writing and arithmetic will no longer be enough to propel students to success in the work place. According to the SCANS (1991) report, researchers identified five competency skill areas and three foundation skill areas that are necessary for success in the workplace. The five competency skills, as defined by SCANS (1991) are:

1. Resources: Identifies, organizes, plans, and allocates resources,
2. Interpersonal: Works with others,
3. Information: Acquires and uses information,
4. Systems: Understands complex interrelationships and,
5. Technology: Works with a variety of technologies.

In addition, included in the SCANS (1991) report is a description of the three-part foundation skill requirement. They are:

1. Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks,
2. Thinking Skills: Thinks creatively, makes decisions, solves problems, knows how to learn and
3. Personal Quality Skills: Displays responsibility, self-esteem, sociability, self-management, integrity and honesty.

Will high school or college graduates be able to master the competency and foundation skills upon graduation? This question focuses on how society is changing and as a result the needs of students who are preparing to enter the workforce have changed.

> Education is our passport to the future, for tomorrow belongs to the people who prepare for it today.
>
> Malcolm X

Educators are seeking new ways to ensure that students have the appropriate skills on a local and national level. On the local level, school officials are re-thinking the design of schools for the information age (Molenda, 1992; Reigeluth, 1987) and on the national level the Bush administration announced America 2000, a new education strategy, designed to provide national educational goals for the nation's schools (Eley, Foley, Freedman & Scheel, 1992). The fundamental purpose for these initiatives is to empower students to tackle the challenges facing them in "the real-world".

Employees can no longer believe in job security (Naisbitt & Aburdene, 1985) or that a college degree alone (without constantly upgrading ones' skills) will propel him or her in the workplace. Employment for many people, currently and in the future, requires a commitment (whether embraced by the employee or imposed by the employer) to change and life-long learning. Naisbitt and Aburdene (1985) argue that "in the new information society where the only constant is change, we can no longer expect to get an education and be done with it. There is not one education, no one skill, that lasts a lifetime now" (p. 141). Furthermore, Packer (1988) argues that if the U.S. economy is to stay competitive, "twenty-five million American workers will need to upgrade their basic skills during the 1990's" (p. 8). This is a low estimate when taking into account the bases for projections are only on the changing mix of jobs and do not include workers who need to upgrade their skills as a result of new technology (Packer, 1988).

Nevertheless, will graduates be ready to face a world that is constantly changing at a rapid pace? There was a time when a clerical employee learned how to type and file and would not have to learn a new procedure for years- if ever. However, today the replacement of a word processor occurs almost as often as the assignment of a new manager. Many times, in response to receiving this new software application, the employee must become proficient without a decrease in productivity. This situation places the employee in the position of seeking the quickest and "least painful" method of training.

By keeping abreast of the changes in society as well as in education and training, instructional technology professionals can play a key role in restructuring the educational system from its current industrial model to a system that reflects the information age. In addition, restructuring that includes integrating electronic technology into the educational system can be one solution for bridging the skill gap from high school or college to the workplace. This restructuring movement can also be the catalyst for using electronic technology as a tool to assist the teacher in developing the competency and basic skills as defined by the SCANS (1991) report. Furthermore, to bridge the skill gap for employees accessing new information, employers are investigating electronic performance support systems (EPSS) which is a computer-based tool designed to assist the employed with on-demand training and support.

The implementation of EPSS in the work place and the restructuring of the educational system are two important trends in the instructional technology field (Eley et al., 1992; Seels, 1993). These trends are important because they represent moving the teaching and learning process in our schools and on-the-job to a new evolutionary stage.

A Proactive Mindset to Change

Systematic Change Process

Change, whether planned or chaotic, brings on stress and anxiety. Moreover, unplanned change combined with minimum involvement from the people affected by the change, produces resistance (Burke, 1982). Furthermore, Burke (1982) argues that "what people resist is not change but loss, or the possibility of loss" (p. 52). This loss is generally one of two kinds: loss of the known and tried or loss of personal choice (Burke, 1982). Rickleman and Henk (1989) argue that change does not have to be unsettling if everyone involved take a proactive stand.

> By taking a proactive stand, we shift from asking "What is going to happen to us in the future?" to "What can we do to create the kind of future we want?" (Rickleman & Henk, 1989, p. 175).

Kurt Lewin, a psychologist and educator, was one of the earlier researchers to take a proactive stance for change. Lewin argued that a key principle to organizational change is a

three-phase change process "unfreezing, moving, and refreezing." In trying to imagine the phases required for change Lewin used the metaphor of melting ice. Unfreezing means reducing the negative forces through new or disconfirming information, which is the function of diagnosis. Changes in attitude, values, structure, feelings, and behavior incorporate the moving stage and refreezing means reaching a new status quo with support mechanisms to maintain the desired behavior (Weisbord, 1987).

Many systematic change models have evolved from Lewin's model of change (Burke, 82). A key issue with Lewin's model is the involvement of everyone associated with the process. In addition, Lewin states "people are likely to modify their own behavior when they participate in problem analysis and solution and more important they are likely to carry out decisions they have helped to make" (Weisbord, 1987, p. 89).

Educational reform is a hot topic in the school system as well as in all levels of government. Recently, the reform movement has been shifting from a disjointed incremental effort towards more of a Gestalt perspective, where the focus of change is on the whole educational system (Bagley & Hunter 1992; Campoy, 1992; David, 1991; Pearlman, 1989; Raywid 1990; Sheingold, 1991).

David (1991) argues that "restructuring presumes the goal for educational system is not simply to catch up to the world, it needs the capacity to continue to evolve as the world continues its rapid pace of change" (p. 77). To reach this goal Reigeluth (1992) identifies "Ernest Boyer (1983), John Goodlad (1984), Theodore Sizer (1984), Lewis Pearlman (1987), Ann Lieberrman and Lynne Miller (1990), Albert Shanker (1990) and Banathy (1991, 1992)" (p. 1) as advocates for systemic change in education. Reigeluth (1992) further argues that true educational reform has occurred only once in our nation's history- when the industrial assembly-line model, which is currently in place today, replaced the one-room schoolhouse. This paper will not address all the issues associated with restructuring the school. However, the author will focus on a small portion of the educational reform movement that considers integrating electronic technology into the classroom and the uses of EPSS as a tool for promoting training and support in education or business and industry work settings.

Integrating Technology into the Educational Process

Restructuring the educational system is not an easy task. It can be a very complicated and long term project yet, the results of reform can be fruitful and enriching especially if decision makers do not view electronic hardware and software as the sole answer for entrenched ills. A decision maker who believes integrating computer-based technology (into the school system) requires simply supplying teachers and students with additional new hardware and software is focusing on a "device-driven" learning environment versus a "student-centered" environment. Bagley and Hunter (1992) cited Rockman who cautions "policy makers against 'technohype', which he describes as the efforts by advocates and vendors to sell technology as the one and only answer to restructuring the school system" (p. 22). Sheingold (1991) further argues that "computer-based technology has been brought into schools during the past decade largely because the technology was seen as important in and of itself-because it was an increasingly central component of the world of adult work" (p. 77). Technology is more than just electronic devices. Eley et al. (1992) define technology as applying scientific principles to solve practical problems- a process that deals with problem solving. This definition decreases the emphasis from specific devices and places it on solving the problem (Wager, 1993). For example instructional design and teaching and learning methodologies fit the definition of technologies, however they are forgotten examples. The author suggests that the lessening of "technohype" can occur by informing decision makers that electronic technology is "a systematic blend of people, materials, methods and machines" (Eley et al., 1992, p. 27).

More important, the integration of computer-based technology into the educational process requires decision-makers to re-think their opinions on several topics- for example their views on:

1. The role of the teacher in the classroom as well as their views on teaching and learning,
2. The organization of student desks and computers in the classroom,
3. The life-cycle and maintenance of computer hardware and software.

In addition Collins (1991) identified, from the literature and observations in schools where teachers are using computers, several major trends on how computer technologies have an affect on the classroom. First, Collins (1991) argues that the role of the teacher will move from a lecturer to a facilitator and coach who actively engages students in long-term computer projects. These projects may simulate relevant "real-world" problems, where students are actively participating in arriving at solutions.

The classroom will shift from desks placed in rows where the whole class participates to desk arranged in small groups. This new classroom arrangement, along with the teacher's encouragement, can provide an environment where students can focus on cooperation and collaboration. Lastly, the author suggests that by exposing students to electronic technology used as a tool or resource for the teacher students will have an opportunity to practice the foundation and competency skills as describe by SCANS (1991).

Sheingold (1991) provides several recommendations that may assist in the change process that includes integrating computer technology. They are as follows:

1. Bring technology and learning to the same 'table' when restructuring is being planned,
2. Reconsider how technology is organized in the district and finally,
3. Work towards teacher expertise in using a critical mass of technology.

Instructional technologists are also facing issues on how to support employees, such as teachers, administrators and business managers, when many school systems, universities and businesses are facing huge budget cuts and downsizing efforts. As a result of these changes, employees are being called upon to "do more with less" and decision makers are looking towards instructional technologists to investigate ways electronic technologies can increase productivity with a leaner workplace and fewer people available for employee support.

Currently, employees may receive their formal training off-the-job in instructor-led courses or by computer-mediated training (interactive video, computer-based training, or a combination of both), however, when the employee returns to the actual job, training and support may consist of human interaction, non-centralized reference manuals or company documentation. Problems arise when employees need specialized training but none is available until several weeks or months later. Uncertainties in the employee's ability also arise when he or she is trying to complete an assignment and need specific support but receive either too much information, conflicting information or no information at all (Brechlin & Rossett, 1991).

Employers can no longer ignore employee training. Decision makers are slowly realizing that training is a factor in ensuring that the workforce is productive. It is only after the elimination of training programs that decision makers sometimes realize its importance.

> "Training is like rowing against the current. Once you stop you are dragged downstream."
>
> Jozef M.M. Ritzen

As a result of these problems, decision makers are entertaining the idea of providing employees

with software applications that provide immediate support and on-the-job training (OJT) from the employee's desktop computer at the specific moment of need.

The development of electronic performance support systems (an integrated electronic system that provides training and support at the moment of need for the employee) is a trend in instructional technology that can bring training and employee support to the desktop computer. In addition, with the introduction and advancements of tools such as: relational and multimedia databases, computer-based training, expert systems and on-line references, the foundation for developing electronic performance support systems (EPSS) is in place.

What is an EPSS?

Since the recent introduction of EPSS into business and industry, leaders in the field are still trying to develop a working definition associated with this tool. Raybould (1990) describes an EPSS as a "computer-based system that improves worker productivity by providing on-the-job access to integrated information advice and learning experiences" (p. 4). Whereas Gery (1991), a leader in the field of EPSS, defines an EPSS as "an umbrella concept that includes any of a variety of performance support interventions delivered on computer to the worker on the job at the time of need" (Clark, 1992, p. 36).

In describing an EPSS there are two major areas to consider, the content and the components of the system. To identify the contents of an EPSS, Gery (1991) uses the term "Infobase" which is the collection of information the employee will inquire into, access, or have presented to him or her when accessing the system. For example, the information located in a text relational database, multimedia database, expert system or on-line reference system are the type of data the employee could select from within an infobase. When manipulating the infobase, the user interacts with the components of the EPSS that can include the following:

> A range of support mechanisms and software tools including an advisory system to help in instructing or executing tasks and decision making, commercially available software programs, organizational specific application software, special purpose software utilities built especially for use within the EPSS and other interactive capabilities (Gery, 1991, p. 42).

Components of a complex EPSS can, ideally, include a combination of hypermedia databases, expert systems, modular interactive training, a dynamic maintenance system, as well as other interactive software support applications, whereas, a basic EPSS may include only a database and an on-line help system (Geber, 1991). The common feature found in both a basic and complex EPSS is the ability of the application to provide information to the user at the moment of need (Scalcs & Yang, 1993).

EPSS in Educational Process

Researchers are investigating and developing EPSS and other support tools in academia as a way to increase productivity in the workplace. Merrill (1993), Gustafson (1993), and Dick, (1993) are advocates for increasing productivity as a result of decreasing the instructional development time by using an EPSS. Educators from Florida state looks towards an EPSS to increase productivity by providing an integrated information and learning system for staff involved in special education. This project is part of Florida State School year 2000 initiative (Huestia, 1993). In the mist of companies as well as academia downsizing employees are being called upon to "do more with less". To assist employees with this change EPSS are being designed to bridge the training and support gap.

Decision makers who are not ready to invest in an EPSS, may consider embedded interactive training, as a solution for some OJT needs. Embedded training, as defined by Andrews (1991), is the integration of multimedia training applications into a workplace tool. EPSS and embedded training applications are moving the training from out of a classroom onto the employee's desktop computer. In to prepare for the coming changes in workplace training, managers, software developers and instructional designers, will be faced with seeking a clearer understanding of the EPSS development process. More specifically, decision makers must addressing the issue of moving the development of training from the end to an earlier software development stage. Therefore, EPSS or an embedded training application will change the way they receive training on-the-job. In addition, individuals involved in developing software must work together in re-thinking how to incorporate the development of training applications as part of the initial software development process.

Changes in Software Development Process

In order to take full advantage of trends such as the computer-base training component of an EPSS, or embedded training, changes in the software development process are necessary. Traditionally the development of training and support documentation have not been an integrated part of the software development process. Howell (1992) provides a summary of six methods used for general software development projects. Of these six techniques, none address training and support as part of the development process. However, advances in computer hardware and software technology have made it possible to integrate embedded training and support within the software development process before the completion of the project.

The author suggests that to effectively develop the training component of an EPSS, embedded training or even non electronic support materials, the traditional software engineering model should be modified. Figure 1. displays a software engineering model that accommodates the parallel development of the application software process, user interface process, and has been modified to incorporate the parallel development of training and user support materials. This abbreviated software development model is one way to displays a general diagram of each of the three development processes. It is important to note that

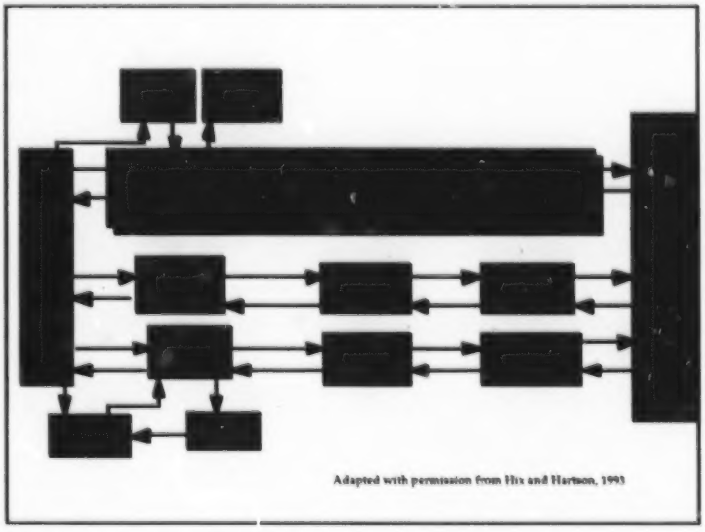

Figure 1. Software development model with training & support

throughout each process efficient and effective communication must occur between each development group. By moving the training and support process from the end of the software development process the user will be able to test a final system complete with training and support materials. In addition, this is one suggestion of a software development model for an EPSS. Furthermore, this change would incorporate the price of training in the overall cost of the system whereby eliminating the purchase of training as an afterthought or as part of the software bundle that is "nice to have".

Summary

Educational reform and the development of EPSS are occurring as the result of the changes in the skills and knowledge needed for the workplace today. Moreover, the implementation of educational reform and EPSS in instructional technology will require following a systematic change process that looks at the entire organization for change and not just single components. Restructuring the educational system is not an easy task therefore it requires advocates for change committed to an on-going and sometimes difficult process. Any advocate for systematic change in education must first question him or herself on their views of teaching and learning and the role of electronic technology in the classroom. Having an advocate for change who is uniformed could potentially promote technology as a cure all versus as a tool for supporting teachers in their teaching and learning process. More important, to successfully integrate computer hardware and software into the teaching and learning practice, advocates for change must prepare teachers and administrators not in just "how" the computer works but also in how the teacher and student can learn "with" the compute using it as a tool or a resource. This concept calls for a change in the role of the teacher, classroom structure and social structure.

Instructional technologists are also being called upon to develop EPSS. The idea of supporting an employee with information, advice and training at their specific moment of need is attractive to employers who are seeking to increase productivity in the mist of downsizing and budget cuts. However EPSS is not a cure all solution for every training situation and does not necessarily mean eliminating additional training before or after using the system.

Lastly, our society has moved from the industrial era to the information and service age. Decision makers, whether in the work place or academia, will require involvement from their entire organization to prepare our future graduates with the appropriate skills for a changing society. Are business leaders, school officials, parents, and students, ready for this challenge?

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Acknowledgment

The author would like to thank Dr. Moore, Dr. Holmes, Mary Tood and Barbara Lockee for our rich discussions and for their assistance with editing the manuscript.